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METHOD OF MAKING COMPOSITE METAL ARTICLES AND PARTING COMPOUND FOR SAME

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This invention relates to a method of making a pack of metal plies, and to a new parting compound to be used therewith. Packs of two-ply metallic members of unlike composition and using parting compounds are well known in this art. The present invention, therefore, relates to a novel method of making a pack composed of plies of stainless steel and carbon steel which utilizes a parting composition having special properties not heretofore known in this art. One of these properties relates to the ease with which the parting compound may be removed at the completion of the rolling operation. Another result following the use of the improved parting compound and the removal of the same is the polished bright metallic surface finish of the clad sheet, as distinguished from the usual dull, non-metallic, corroded and rough finishes obtained as a result when other conventional parting compounds are used. The manufacture of composite metal members either by the pack method, or by the casting method, has been practiced for many years, as will be understood by referring to the Orr Patent 2,160,559, dated May 30, 1939, which discloses the former, or the Ingersoll Patent 2,094,538, dated September 28, 1937, which is an example of the latter method. Both patents also disclose examples of the use of parting compounds in such methods. The present invention pertains to the use of a novel parting compound for use in either of these well known methods, as stated hereinafter.

According to the process, two metal slabs of like character, i.e. composed of layers of titanium or zirconium, having polished, smooth, clean, or otherwise suitably prepared surfaces, are placed together with such prepared surfaces in juxtaposed relation but separated by a medium, i.e. parting compound that prevents permanent or substantial welding of said surfaces in the subsequent operations. These plates, slabs, or the like, may be composed of a corrosion and heat-resistant type of alloy, of which the so-called stainless steels are typical. The backing sheet plate or slab which forms part of the pack may be composed of carbon steel.

More specifically, pairs of two-ply members, such as shown in FIGURE 2 of the patent to Keay 2,813,332, one ply of each pair being of stainless steel and the other ply being of carbon steel, are formed into a pack and their edges are sealed by welding or other means after a separating compound has been applied to one or both of the contacting faces of the adjacent pairs of stainless steel plates or slabs.

The separating or parting compound may be applied by brushing, dipping, or spraying of an aqueous solution, or an aqueous or organic media with or without an organic or inorganic binder, of fluorides, preferably calcium fluoride, but cryolite, chiolite, aluminum fluoride, and chromium fluoride may be also used.

Although the pack may be composed of alternating layers of stainless steel and carbon steel, the present invention has particularly for its purpose the provision of a method of making clad steel, particularly titanium or zirconium clad steel, and a clad steel product, or a parting compound per se.

It has been found that calcium fluoride and other fluorides when used as a parting compound have resulted in a superior product. The exposed cladding surface has a bright, diffused, metallic finish, much superior to the usual dull, non-metallic, corroded and rough finishes obtained from the use of oxide-containing parting compounds.

The primary object of the invention, therefore, is to provide a method of making composite metal articles, particularly of titanium or zirconium clad steel, by using a parting compound comprising fluorides or fluoride compounds.

The most notable feature of a parting compound comprising such fluorides as calcium fluoride, cryolite, chiolite, aluminum fluoride and chromium fluoride is that the residual material, following the usual heating and rolling steps, flaked off very readily or came off of itself when the pack was broken apart. It was found that the remainder of the material could be easily removed, even by the use of a fingernail, because of its relatively non-adhering character.

In undertaking the use of fluorides or their compounds as a parting material, it was initially considered that the fluorides would cause etching of the surface of the cladding layer, particularly titanium or zirconium. However, it has been found by actual tests that the fluorides and their compounds provide a better finish than is customarily obtained when using parting compounds containing chromium oxide or other parting compounds heretofore known.

The coating slurry may be made up in any suitable concentration which can readily be sprayed or brushed onto the surface of a slab or which will form a suitable slurry for dipping. It also can be applied by chemical means as by double decomposition or by colloidal precipitation, or mechanically by dusting in powdered form, or sedimentation.

By way of example, after the prepared surfaces have been properly coated, the plates or slabs are placed in juxtaposed relation with the coated, prepared, surfaces together, and the adjacent edges of the metal slabs are preferably sealed, as by welding, around a common surface area so as to prevent damage to the inner or enclosed surfaces during the subsequent operations that usually take place after the pack is formed. Alternately, clad may be made by casting instead of the above method as shown in the Ingersoll Patent 2,094,538 of September 28, 1937, noted above. The insert, after coating with a parting composition of fluorides, is placed in a mold, and a metal, usually of a different character or analysis, as carbon or alloy steel or other metal, is poured around the slab and allowed to cool. The composition of the poured metal will depend largely on the ultimate use of the finished product, and may be any ferrous metal or alloy capable of being bonded with or welded to the insert.

The composite slab is preferably of titanium or zirconium clad steel, a product which is very hard to fabricate due to the type of metals used.

After the contents of the mold have cooled, the composite ingot is removed from the mold and again heated to rolling, forging, or welding temperature. The composite ingot is then hot pressed one or more times through rolls to spread it out into a composite or laminated sheet. The rolling operation is preferably continued until the composite or laminated sheet is a multiple number of times the desired thickness of the ultimate sheet.

After the composite sheet has been rolled down to the desired thickness, the marginal edges are clipped off back to the edges of the common surfaces to permit separation along such surfaces, said separation in accordance with accepted practices when using parting compounds. As previously indicated, the parting medium, namely the fluorides, prevents substantial bonding of the juxtaposed surfaces that have been coated with this sepa-

rating medium, so that as soon as the marginal edges have been clipped, separation is readily effected. Where fluorides such as fluorspar, i.e. calcium fluoride, cryolite, chiolite, aluminum fluoride, and chromium fluoride have been used as the parting compound or separating medium, the particular fluoride used prevents the welding together of the prepared surfaces, and it has been found that the exposed faces of the cladding material sheets have a bright, diffused, metallic finish, much superior to the usual dull, non-metallic, corroded and rough finishes obtained from other parting compounds, such as oxide-containing parting compounds, particularly when used in the production of titanium clad steel. The present invention relates generally to the production of composite metal articles known also to the art as clad steel, typical examples of which are disclosed in the above noted patents.

One of the important features of the use of fluorides as a parting compound is that the residual material flakes off very readily and some of it may come off by itself while the remainder may be readily removed by a brush or other similar means.

Another important result of the use of fluorides in parting compounds is the superior finish of the exposed faces of the cladding layer, such as the titanium or zirconium clad steel.

Although the above description discloses a single embodiment of the invention, it will be understood that no limitations of the scope of the invention are thereby contemplated, and that various alterations and modifications may be made such as would occur to one skilled in the art to which the invention relates.

We claim:

1. In a method of preparing a composite metal article in cladding operations, the step of forming a pack, said pack having at least one pair of cladding sheets from the class consisting of titanium and zirconium and inserting a parting material between said sheets whereby to form a coated surface between said sheets, said parting material containing fluorides of the class consisting of calcium fluoride, cryolite, aluminum fluoride and chromium fluoride and mixtures thereof, placing base metal layers of carbon steel or the like on the outer surfaces of the said cladding sheets, sealing the adjacent edges of the pack as assembled, heating the pack to a welding temperature, and rolling under sufficient heat and pressure to weld the base metal layers to the cladding sheets.

2. The method of claim 1 wherein said pack has at least one pair of cladding sheets of titanium.

3. The method of claim 1 wherein said pack has at least one pair of cladding sheets of zirconium.

4. A method of preparing a composite metal article in cladding operations including the step of assembling two layers of a cladding metal from the class consisting of titanium and zirconium in face-to-face relationship, coating at least one of said faces with a composition containing fluorides of the class consisting of calcium fluoride, cryolite, chiolite, aluminum fluoride and chromium fluoride and mixtures thereof, sealing the adjacent edges of the cladding layers and then placing the assembly in a mold and casting molten base metal about the assembly in the mold, and removing the cast assembly from the mold and rolling under sufficient heat and pressure to weld the base metal to the cladding layers.

5. The method of claim 4 wherein the two layers of cladding metal consist of titanium only.

6. The method of claim 4 wherein the two layers of cladding metal consist of zirconium.

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